JAPANESE [JP,2000-308135,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

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CLAIMS

[Claim(s)]
[Claim 1] On the frequency of all predetermined bands, the broadband wireless transceiver means in which wireless transmission and reception are possible, The wireless analog signal and wireless digital signal of a broadband which are transmitted and received with said broadband wireless transceiver means A broadband A/D-D/A conversion means convertible in both directions, While carrying out wireless baseband processing required for the digital radio which includes channel separation and strange recovery processing in said wireless digital signal using a software radio technique It is the mobile radio terminal which has a digital-signal-processing means by which control processing of each part of a mobile radio terminal including voice grade data processing and said each means before and behind this wireless baseband processing can be carried out. Said digital-signal-processing means downloads and memorizes the software using said software radio technique containing the software which defines a wireless function from the receiving circuit used for said radio. The mobile radio terminal characterized by enabling the communication link between the migration communication system with which the memorized this software is started, implementation of said wireless baseband processing is possible at least with communication system, one of the migration communication system with which plurality differs is chosen, and plurality differs.
[Claim 2] Said mobile radio terminal is a mobile radio terminal according to claim 1 characterized by judging what the system of a circumference base station is by performing a set up tree channel scan common to all systems to a power up, setting up parameters, such as a modulation technique common to all systems, and an access method, and receiving information common to all systems.
[Claim 3] Download of said software is a mobile radio terminal according to claim 1 or 2 characterized by carrying out as a message which used the control channel.
[Claim 4] It is the mobile radio terminal according to claim 1 to 3 characterized by performing download of said software through the "user user" information element of the "User Information" message of layer 3 call control in an open systems interconnection (OSI) model.
[Claim 5] the mobile radio terminal according to claim 1 to 3 characterized by performing download of said software through the layer 3 wireless management message or migration management message "the operator proper information" in an open systems interconnection (OSI) model.
[Claim 6] For the software which defines said wireless function to download The software demand including the information which shows at least the class of software set as the object of a demand, The software response including the information which shows the class and version of the software set as the object of a response, The download control including the information which shows the class of software set as the object of download, initiation of download, and termination, The download response including the information which shows the propriety of reception of the class of software set as the object of download, initiation of download, termination, and download, Download data including the information which shows a number of [the / which the download data divided], Download data validation including the information which shows a number of [the / which the checked download data divided], A mobile radio

terminal given in any 1 term of claims 1-5 characterized by including the definition of each inclusion message with the software change including the information which shows the class and version of the downloaded software.
[Claim 7] It is a mobile radio terminal given in any 1 term of claims 1-6 which said mobile radio terminal measures the receive state of the signal from two or more base stations, change it to other channels or alien systems when a receive state changes, and are characterized by said receive state being any 1 of field strength, the rate of a word fault, and bit error rates, or such two or more combination.
[Claim 8] Said receive state is a mobile radio terminal according to claim 7 characterized by being the function of the field strength defined for every migration communication system.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the mobile radio terminal using the software radio technique of obtaining in more detail the software used for radio by download, about the mobile radio terminal which communicates while changing a network between the migration communication system with which plurality differs.
[0002]
[Description of the Prior Art] While a cellular phone, PHS, a pager, etc. spread quickly in recent years, in those mobile networks, the advancement of the communication facility by an addition and data communication correspondence of new service, or the function on a network and diversification of a specification are progressing. That is, the communication link which contains an image, an animation, data, an alphabetic character, music, etc. as well as voice by the multimedia mobile communications with which who or any data can communicate is possible always anywhere. However, various migration communication system exists all over the world, and it is incompatible among these. For this reason, in order to actually move in the inside of the world and to communicate a pocket mold in every migration place, the terminal of each migration communication system had to be prepared, or the multimode terminal had to be used. In order to solve this problem, the standardization of IMT2000 which is a world unification system is performed in ITU-T, but the existing system must be used until that standardization is realized. Conventionally, the equipment which prepares the circuit corresponding to two or more systems, and changes these circuits into one terminal as a multimode terminal at JP,10-84583,A, JP,10-84584,A, etc., for example is proposed, and also when it moves to the service area of the system using a different frequency and a different protocol according to these means, a communication link can be continued, without being interrupted.
[0003]
[Problem(s) to be Solved by the Invention] However, at the conventional multimode mobile radio terminal, the circuit corresponding to two or more systems had to be prepared into one terminal, and there was a problem that a request called the formation of small lightweight and reduction of power consumption could not fully be attained compared with the dedicated terminal of each system. Since a limitation would be generated in the number of circuits which can be held physically if it is going to realize a miniaturization, although the change to the system by which the circuit is prepared was completed, the change to the system by which the circuit is not prepared had the problem that it could not do. the purpose of this invention be offer the multimode mobile radio terminal which communicate while change a network between the migration communication system with which plurality differed quickly by be make in order to solve the above-mentioned problem, and software describe the basic function of walkie-talkies, such as strange recovery processing constituted from hardware, using a software radio (SR) technique, and download the basic function conventionally.
[0004]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, it sets to invention of claim 1. On the frequency of all predetermined bands, the broadband

wireless transceiver means in which wireless transmission and reception are possible, The wireless analog signal and wireless digital signal of a broadband which are transmitted and received with said broadband wireless transceiver means A broadband A/D-D/A conversion means convertible in both directions, While carrying out wireless baseband processing required for the digital radio which includes channel separation and strange recovery processing in said wireless digital signal using a software radio technique It is the mobile radio terminal which has a digital-signal-processing means by which control processing of each part of a mobile radio terminal including voice grade data processing and said each means before and behind this wireless baseband processing can be carried out. Said digital-signal-processing means downloads and memorizes the software using said software radio technique containing the software which defines a wireless function from the receiving circuit used for said radio. The memorized this software is started, implementation of said wireless baseband processing is possible at least, one of the migration communication system with which plurality differs is chosen, and it is characterized by enabling the communication link between the migration communication system with which plurality differs. In invention of claim 2, said mobile radio terminal is characterized by judging what the system of a circumference base station is in a mobile radio terminal according to claim 1 by performing a set up tree channel scan common to all systems to a power up, setting up parameters, such as a modulation technique common to all systems, and an access method, and receiving information common to all systems. In invention of claim 3, download of said software is characterized by carrying out as a message which used the control channel in a mobile radio terminal according to claim 1 or 2. In invention of claim 4, it is characterized by performing download of said software through the "user user" information element of the "User Information" message of layer 3 call control in an open systems interconnection (OSI) model in a mobile radio terminal according to claim 1 to 3. In invention of claim 5, it is characterized by performing download of said software through the layer 3 wireless management message or migration management message "the operator proper information" in an open systems interconnection (OSI) model in a mobile radio terminal according to claim 1 to 3. In invention of claim 6, for the software which defines said wireless function to download as any 1 term of claims 1-5 in the mobile radio terminal of a publication The software demand including the information which shows at least the class of software set as the object of a demand, The software response including the information which shows the class and version of the software set as the object of a response, The download control including the information which shows the class of software set as the object of download, initiation of download, and termination, The download response including the information which shows the propriety of reception of the class of software set as the object of download, initiation of download, termination, and download, Download data including the information which shows a number of [the / which the download data divided], It is characterized by including the definition of each inclusion message of download data validation including the information which shows a number of [the / which the checked download data divided], and the software change including the information which shows the class and version of the downloaded software. In invention of claim 7, it sets to a mobile radio terminal given in any 1 term of claims 1-6. It is what is changed to other channels or alien systems when said mobile radio terminal measures the receive state of the signal from two or more base stations and a receive state changes. It is characterized by said receive state being any 1 of field strength, the rate of a word fault, and bit error rates, or such two or more combination. In invention of claim 7, it is characterized by said receive state being the function of the field strength defined for every migration communication system in a mobile radio terminal according to claim 7.

[0005]

[Embodiment of the Invention] First, the software radio technique (it is hereafter indicated as SR.) used by this invention is explained. The basic function of a wireless terminal can be easily changed only by rewriting software, without SR's realizing the basic function of walkie-talkies, such as a strange recovery method and an access method, by software, and performing a hardware change. "System extensiveness" function in SR terminal is performed by download through wireless, and the limitation of the technique depending on hardware which was described

above is also conquered by the above "system extensiveness" by downloading VHDL (Verilog Hardware Discript Language) etc. In addition, about the detail of SR, it is Joe Mitola. : It is stated to "The Software Radio Architecture", IEEE Communications Magazine, Vol.33, No.5, and pp.26-38 (May 1995).

[0006] Below, the operation gestalt of this invention is explained based on the gestalt of operation shown in the drawing in order of a hardware configuration, a software configuration, the handling of the software to download, and a download sequence. Drawing 1 is the configuration schematic diagram showing the configuration of the general hardware of the terminal using SR concerning this invention. as shown in this drawing, this terminal consists of an antenna 1, an RF transducer 2, a broadband A/D-D/A transducer (the following and AD section -- ** -- it says) 3, and the software processing section 4, and the software processing section 4 consists of the wireless baseband processing section 41, the data-processing section 42, and a control section 43 further. It is the part to which download of the software whose software processing section 4 is the description of this invention among the above-mentioned configurations is applied, and is the part from which it consisted of hardware at the Prior art, and processing by software was not performed, therefore especially the wireless baseband processing section 41 was not set as the object of download in it.

[0007] The actuation of the terminal of the above-mentioned configuration is as follows. The broadband signal inputted from the antenna 1 is changed into an intermediate frequency IF by the RF transducer 2. This IF signal is sent to the AD section 3 with a broadband. In the AD section 3, the inputted broadband signal is collectively changed into a digital signal, and it outputs to the wireless baseband processing section 41 in the software processing section 4. In the wireless baseband processing section 41, said SR technique performs "channel processing" of bit manipulation, such as channel separation, a strange recovery, and an error correction. Although the conventional configuration is performing processing of the wireless baseband processing section 41 by hardware, it is performed at this terminal by the software on high-speed programmable processors, such as DSP (Digital Signal Processor). Voice etc. is sent to the data-processing section 42 among the digital signals from the wireless baseband processing section 41, and communications control data are sent to a control section 43. Based on the communications control data sent from the wireless baseband processing section 41, a control section 43 performs wireless line control, call connection control, etc., and has two systems to the data to download. The data-processing section 42 performs data processing, such as FAX besides speech processing, and a modem. As mentioned above, conversely, although the outline of operation at the time of wireless reception of this terminal was explained, when it sends out a sending signal from the wireless baseband section 41, D/A conversion of the sending-out signal is carried out in the AD section 3, and power amplification is carried out to frequency conversion by the RF transducer 2, and it is transmitted to a base station etc. through an antenna 1.

[0008] Next, the configuration of the software in the hardware of drawing 1 is explained. Drawing 2 is the software configuration Fig. of the radio terminal which used SR, and consists of the baseband processing section 5, a download control section 6, and the communications control section 7. The baseband processing section 5 is software which processes software which performs each processing of the channel separation processing 51, the strange recovery processing 52, and the bit stream processing 53, and is downloaded including the basic function explained in the wireless baseband processing section 41 of above-mentioned drawing 1 . The download control section 6 controls download of software, and operates according to the control command sent before and after the data of download sent from a network side through the communications control section 7 mentioned later, and its data etc. Moreover, transmission and reception of the signal of the baseband processing section 5 are controlled. The communications control section 7 is the same as that of the conventional terminal, and is shown in following drawing 3 in detail.

[0009] Drawing 3 is drawing showing the software structure of the communications control section 7 of drawing 2 , and the layer structure of OSI is used for it by drawing 3 . In drawing 3 , the higher layer section (HMI) 17 performs the dial input from a keyboard, the various information displays to LCD, etc. Both the layer 3 (RT, MM, CC) section 15 and the higher layer section (RT,

MM, CC) 16 which is the high order layer (a service layer is called) have a wireless function manager (RT), a migration function manager (MM), and a call processing function (CC). A wireless function manager (RT:Radio Frequency Transmission Management) means control of a wireless circuit, and a migration function manager (MM: Mobility Management) means location registration and authentication. A call processing function (CC: Call Control) means call connection control of dispatch, arrival, etc., and actuation based on ITU-T Q.931 is performed. The Rhea 2 section 14 indicated to be a layer 2 performs link access processing (LAPDM:Link Access Procedure for Digital Mobile channel), and carries out actuation based on ITU-T Q.921. The Rhea 1 section 13 performs the directions to channel coding of frame synchronization and a data frame, and the **-SUBANDO processing section 5. Under control of management 11, each layer is unified, and sends and receives a signal with a network. The software shown in these drawing 2 and drawing 3 operates on real-time OS. As mentioned above, as software of this operation gestalt, the baseband processing section 5 which is the object of download, and the download control section 6 and the communications control section 7 are constituted separately.

[0010] Next, the handling of the software to download is explained. As the approach of the download to a radio terminal from a network side, fundamentally, although it is carried out through wireless as mentioned above, in it, there are an approach of sending by the information channel (TCH) as "User Information" and the approach of sending by the control channel (CCH) as a "message" about the communications control transmitted by the layer 3 like voice or modem data about the program data to download. Generally, it is thought that it is appropriate to them to deal with it as "User Information" since program data, such as software, are not the "messages" about communications control. However, since data, such as voice, and FAX, a modem, are transmitted as "User Information" during the communication link, it is impossible for it to become impossible to use service usual in under download, and to perform software download to coincidence during the communication link of "User Information." Then, it enables it to deal with program data as a "message" with the operation gestalt of this invention. It becomes possible to use a control channel (CCH) for coincidence and to perform software download to it, transmitting voice etc. using an information channel (TCH), if it does in this way. The message used for download is taken as the "User Information" message of layer 3 call control. Since the transmission protocol of a message and coding being specified and the reason's being general and a call control message are transmitted by one frame of a layer 2, they are that a resending control function occurs. Moreover, it is because all one message of a standard of the "User Information" message and a layer 2 is diverted, so adjustment with the existing system can also be maintained.

[0011] In the standard, since the concrete operation of the "user user" information element specified as one of the elements of the "User Information" message was not specified, it incorporates a message there and was made to download by sending and receiving "User Information." Following seven are defined as a message (an "inclusion message" is called below) included in User Information.

(1) Software version demand : the information which shows the software class (for example, communications control, wireless baseband, download control) set as the object of a demand appears.

(2) Software version response : the software class set as the object of a response and its version information appear.

(3) Download control : the information which shows initiation/termination of the software class used as the candidate for download and download appears.

(4) Download response : the information which shows whether the software class used as the candidate for download, initiation/termination of download, and download control were received appears.

(5) Download data : the information which indicates a number of [the / which it divided] to be download data appears.

(6) Download data validation : the information which shows a number of [the / which the checked data divided] appears.

(7) The class and version information of the software downloaded [which downloaded and

software-changed] appear.
[0012] Next, the sequence of download of software is explained. Drawing 4 is a message inspection sequence chart (it is called a sequence diagram Message Sequence Chart and the following) which shows the outline of the download in the operation gestalt of this invention. In this drawing, the version check:network of (1) software requires the version (S1) of terminal software, and a terminal returns a version (S2).
(2) Download initiation : a network returns delivery to this and a terminal returns a response (S4) for a download initiation command (S3).
(3) Download : divide the whole data and download it from a network to a terminal (S5). An error check etc. enters suitably during download.
(4) Download termination : after download of the whole data is completed, a network returns delivery to this and a terminal returns a response (S7) for a download termination command (S6).

(5) Software change : a network changes a software change command (S8) to the software which delivery and a terminal downloaded newly.
[0013] About the download (S5) shown in the sequence diagram of said drawing 4 , the detail is further shown in drawing 5 . In drawing 5 , the whole program to download is divided into two or more bytes so that it may appear in a "user user" information element. Calling Window the unit which performs resending control between a network and a terminal, one Window shall consist of N cutting tool. The whole data to download is first divided into M Window(s) (Win=1-/M-Win=M/M). Each of the download data divided into M pieces attaches a number (Div=1/N-Div=N/N) further for every Window of the, and is sent in order. This number is called Division. In drawing 5 , a terminal will return the response (S54) of the purport that reception of the Window (Win=1) concerned was checked, if the data (S51-S53) of N individual are received. A network transmits the data of the next Window (Win=2) in order (S55-S56) succeedingly, when transmission of one Window is successful in response to a response (S54).
[0014] Here, since the response (S57) of a check does not return to a network when reception of Window (Win=2) goes wrong for example, by the terminal side, the whole data of the Window (Win=2) is resent in a network. According to the above-mentioned procedure, download processing of Window is successively repeated until Window (Win=M) of the last of all data is sent out from a network (S58), the response (S59) is returned hereafter and download of all Window(s) finishes.
[0015] By the way, with the operation gestalt of this invention, as shown in drawing 3 , download is performed using the information element "a user user" of a layer 3 call-control message "User Information." Thereby, download is made possible through the control channel, performing voice transmission through an information channel. Furthermore, since the message of a standard is diverted, adjustment with the existing system can also be maintained.
[0016] Thus, with the operation gestalt of this invention, the system service as which the standardization was newly determined also in the mobile radio terminal can be immediately offered [by giving the download function of software to the mobile radio terminal which used SR technique] after the standardization decision of the standardization decision of systems specification or before, or systems specification like modification by download of the system software in the base station of the conventional network. If it realizes according to this invention using SR technique which described above the dual mode terminal of a different access method like TDMA and CDMA, once by for example, the case where a mobile radio terminal is distributed by method of one of the two Even if it is the case where it changes into the method of another side of the software about the basic function of walkie-talkies, such as channel separation, strange recovery processing, and bit stream processing, it can be made to correspond to a communication mode which is different, without carrying out a hardware change by download which led the radio circuit. Furthermore, when it is made adapted for the dual mode machine of a digital cellular phone (PDC) and a CDMA method cellular phone, specifically, it is effective.
[0017] In addition, although the above-mentioned explanation explained the message used for download as "User Information" of call control, it can consider as the "operator proper information" on wireless management or migration management. In using an "operator proper

information" message for download, there is no convention in the transmission protocol, coding, and a usage, and a degree of freedom comes out more from the operator having taken all. Moreover, since wireless management MESSE 1 JI and a migration management message are transmitted with the UI frame of a layer 2, compared with I frames, it passes and the advantage that there is little DDA and transmission speed becomes high comes out.

[0018] Next, the change to other channels or alien systems is explained. Drawing 6 is a flow chart which shows the change actuation to other channels. The part enclosed with a broken line is the judgment block of channel change conditions among drawing. In this drawing, a terminal is awaited and creates the table which carried out the firm measurement of the field strength of the discharge electric wave from two or more circumference base stations, compared them, and arranged the code of a base station in the strong sequence of an electric wave inside or during the communication link. L0 awaits the greatest thing and Lt1 for the receiving level of the base station under communication link, and Lm among the receiving level of a circumference base station, degradation level and Lt2 await, authorization level and **L=Lt1-Lt2 are zone shift level differences, the terminal has memorized these change information beforehand, or it is notified from a base station. A terminal changes a channel, when the predetermined criteria are met. In addition, by downloading software in the case of a channel change, the change to an alien system can be performed and a multimode mobile radio terminal can be realized. As mentioned above, although the example which performed the change to other channels or alien systems based on field strength was shown, if it considers as the parameter which shows a receive state, the rate of a word fault and a bit error rate may be used. Moreover, if it uses combining these two or more, since a receive state will be expressed more to a detail, it is effective by the opportunity of a change being shown. Moreover, different amendment of the covering area of a base station or a modulation technique for every system can be carried out by using the function of the field strength defined for every system as a receive state.

[0019] Although change actuation of the system in the terminal of drawing 6 is awaited and it is the system change inside or under communication link, the system decision of a power up is made as follows. Fig. 7 is a flow chart which shows set up tree channel scan actuation of a power up. To a power up, by scanning actuation according to said flow chart, a terminal measures the field strength of the electric wave of a circumference base station, compares them, and creates the table of a frequency at order with strong field strength. Although a **** awaits this actuation and it is the same as that of inner actuation, it is the description that the frequency which measures field strength is common to all systems.

[0020] Drawing 8 is a flow chart which shows system decision actuation of a power up. While setting up the frequency in the head of a table, parameters, such as a modulation technique common to all systems, an access method, and a bit rate, are set up (S1), and the layers 1, such as frame synchronization and CRC, are checked (S2). Although a **** awaits the above actuation and it is the same as that of inner actuation, it is the description that parameters to set up, such as a modulation technique and an access method, are common to all systems. Information common to all systems is received after a setup of a parameter (S3). since the frequency of the system under service, channel structure, the modulation technique, the access method, the frame format, etc. are included in this common information in the area of a common base station -- a radical [information / that] -- awaiting -- a system -- determining -- (S4) -- it shifts to awaiting. When common information is unreceivable, the last channel is checked (S5) and a channel is set up again (S1). Here, conventionally, although it was confirming whether the combination of a parameter would remain, in this invention since [a parameter] it is common to all systems, it is not necessary to perform the check of combination and a system can be determined early. Thus, the next frequency of a table is received until it can perform reception of common information. The terminal applied to this invention as explained above is performing a set up tree channel scan common to all systems to a power up, setting up a modulation technique common to all systems, an access method, etc., and receiving common information, and it becomes clear what the system of a circumference base station is. For this reason, a system decision can be made promptly and a terminal can be used immediately.

[0021]

[Effect of the Invention] Since software is constituted from the wireless baseband processing section, a download control section, and the communications control section and it was made to perform software download at the mobile radio terminal concerning this invention through the layer 3 call control "User Information" message using SR technique as explained above, the basic function itself, such as a strange recovery method in a mobile radio terminal, can be changed easily, and a multimode mobile radio terminal can be realized. Furthermore, a set up tree channel scan common to all systems is performed to a power up, a modulation technique common to all systems, an access method, etc. are set up, and since it was made for what the system of a circumference base station is by receiving common information to judge, the system decision of a power up is realizable for a high speed.

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the mobile radio terminal using the software radio technique of obtaining in more detail the software used for radio by download, about the mobile radio terminal which communicates while changing a network between the migration communication system with which plurality differs.

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PRIOR ART

[Description of the Prior Art] While a cellular phone, PHS, a pager, etc. spread quickly in recent years, in those mobile networks, the advancement of the communication facility by an addition and data communication correspondence of new service, or the function on a network and diversification of a specification are progressing. That is, the communication link which contains an image, an animation, data, an alphabetic character, music, etc. as well as voice by the multimedia mobile communications with which who or any data can communicate is possible always anywhere. However, various migration communication system exists all over the world, and it is incompatible among these. For this reason, in order to actually move in the inside of the world and to communicate a pocket mold in every migration place, the terminal of each migration communication system had to be prepared, or the multimode terminal had to be used. In order to solve this problem, the standardization of IMT2000 which is a world unification system is performed in ITU-T, but the existing system must be used until that standardization is realized. Conventionally, the equipment which prepares the circuit corresponding to two or more systems, and changes these circuits into one terminal as a multimode terminal at JP,10-84583,A, JP,10-84584,A, etc., for example is proposed, and also when it moves to the service area of the system using a different frequency and a different protocol according to these means, a communication link can be continued, without being interrupted.

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EFFECT OF THE INVENTION

[Effect of the Invention] Since software is constituted from the wireless baseband processing section, a download control section, and the communications control section and it was made to perform software download at the mobile radio terminal concerning this invention through the layer 3 call control "User Information" message using SR technique as explained above, the basic function itself, such as a strange recovery method in a mobile radio terminal, can be changed easily, and a multimode mobile radio terminal can be realized. Furthermore, a set up tree channel scan common to all systems is performed to a power up, a modulation technique common to all systems, an access method, etc. are set up, and since it was made for what the system of a circumference base station is by receiving common information to judge, the system decision of a power up is realizable for a high speed.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, at the conventional multimode mobile radio terminal, the circuit corresponding to two or more systems had to be prepared into one terminal, and there was a problem that a request called the formation of small lightweight and reduction of power consumption could not fully be attained compared with the dedicated terminal of each system. Since a limitation would be generated in the number of circuits which can be held physically if it is going to realize a miniaturization, although the change to the system by which the circuit is prepared was completed, the change to the system by which the circuit is not prepared had the problem that it could not do. the purpose of this invention be offer the multimode mobile radio terminal which communicate while change a network between the migration communication system with which plurality differed quickly by be make in order to solve the above-mentioned problem, and software describe the basic function of walkie-talkies, such as strange recovery processing constituted from hardware, using a software radio (SR) technique, and download the basic function conventionally.

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3.In the drawings, any words are not translated.

MEANS

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, it sets to invention of claim 1. On the frequency of all predetermined bands, the broadband wireless transceiver means in which wireless transmission and reception are possible, The wireless analog signal and wireless digital signal of a broadband which are transmitted and received with said broadband wireless transceiver means A broadband A/D-D/A conversion means convertible in both directions, While carrying out wireless baseband processing required for the digital radio which includes channel separation and strange recovery processing in said wireless digital signal using a software radio technique It is the mobile radio terminal which has a digital-signal-processing means by which control processing of each part of a mobile radio terminal including voice grade data processing and said each means before and behind this wireless baseband processing can be carried out. Said digital-signal-processing means downloads and memorizes the software using said software radio technique containing the software which defines a wireless function from the receiving circuit used for said radio. The memorized this software is started, implementation of said wireless baseband processing is possible at least, one of the migration communication system with which plurality differs is chosen, and it is characterized by enabling the communication link between the migration communication system with which plurality differs. In invention of claim 2, said mobile radio terminal is characterized by judging what the system of a circumference base station is in a mobile radio terminal according to claim 1 by performing a set up tree channel scan common to all systems to a power up, setting up parameters, such as a modulation technique common to all systems, and an access method, and receiving information common to all systems. In invention of claim 3, download of said software is characterized by carrying out as a message which used the control channel in a mobile radio terminal according to claim 1 or 2. In invention of claim 4, it is characterized by performing download of said software through the "user user" information element of the "User Information" message of layer 3 call control in an open systems interconnection (OSI) model in a mobile radio terminal according to claim 1 to 3. In invention of claim 5, it is characterized by performing download of said software through the layer 3 wireless management message or migration management message "the operator proper information" in an open systems interconnection (OSI) model in a mobile radio terminal according to claim 1 to 3. In invention of claim 6, for the software which defines said wireless function to download as any 1 term of claims 1-5 in the mobile radio terminal of a publication The software demand including the information which shows at least the class of software set as the object of a demand, The software response including the information which shows the class and version of the software set as the object of a response, The download control including the information which shows the class of software set as the object of download, initiation of download, and termination, The download response including the information which shows the propriety of reception of the class of software set as the object of download, initiation of download, termination, and download, Download data including the information which shows a number of [the / which the download data divided], It is characterized by including the definition of each inclusion message of download data validation including the information which shows a number of [the / which the checked download data divided], and the software change including the

information which shows the class and version of the downloaded software. In invention of claim 7, it sets to a mobile radio terminal given in any 1 term of claims 1-6. It is what is changed to other channels or alien systems when said mobile radio terminal measures the receive state of the signal from two or more base stations and a receive state changes. It is characterized by said receive state being any 1 of field strength, the rate of a word fault, and bit error rates, or such two or more combination. In invention of claim 7, it is characterized by said receive state being the function of the field strength defined for every migration communication system in a mobile radio terminal according to claim 7.

[0005]

[Embodiment of the Invention] First, the software radio technique (it is hereafter indicated as SR.) used by this invention is explained. The basic function of a wireless terminal can be easily changed only by rewriting software, without SR's realizing the basic function of walkie-talkies, such as a strange recovery method and an access method, by software, and performing a hardware change. "System extensiveness" function in SR terminal is performed by download through wireless, and the limitation of the technique depending on hardware which was described above is also conquered by the above "system extensiveness" by downloading VHDL (Verilog Hardware Discript Language) etc. In addition, about the detail of SR, it is Joe Mitola. : It is stated to "The Software Radio Architecture", IEEE Communications Magazine, Vol.33, No.5, and pp.26-38 (May 1995).

[0006] Below, the operation gestalt of this invention is explained based on the gestalt of operation shown in the drawing in order of a hardware configuration, a software configuration, the handling of the software to download, and a download sequence. Drawing 1 is the configuration schematic diagram showing the configuration of the general hardware of the terminal using SR concerning this invention. as shown in this drawing, this terminal consists of an antenna 1, an RF transducer 2, a broadband A/D-D/A transducer (the following and AD section -- ** -- it says) 3, and the software processing section 4, and the software processing section 4 consists of the wireless baseband processing section 41, the data-processing section 42, and a control section 43 further. It is the part to which download of the software whose software processing section 4 is the description of this invention among the above-mentioned configurations is applied, and is the part from which it consisted of hardware at the Prior art, and processing by software was not performed, therefore especially the wireless baseband processing section 41 was not set as the object of download in it.

[0007] The actuation of the terminal of the above-mentioned configuration is as follows. The broadband signal inputted from the antenna 1 is changed into an intermediate frequency IF by the RF transducer 2. This IF signal is sent to the AD section 3 with a broadband. In the AD section 3, the inputted broadband signal is collectively changed into a digital signal, and it outputs to the wireless baseband processing section 41 in the software processing section 4. In the wireless baseband processing section 41, said SR technique performs "channel processing" of bit manipulation, such as channel separation, a strange recovery, and an error correction. Although the conventional configuration is performing processing of the wireless baseband processing section 41 by hardware, it is performed at this terminal by the software on high-speed programmable processors, such as DSP (Digital Signal Processor). Voice etc. is sent to the data-processing section 42 among the digital signals from the wireless baseband processing section 41, and communications control data are sent to a control section 43. Based on the communications control data sent from the wireless baseband processing section 41, a control section 43 performs wireless line control, call connection control, etc., and has two systems to the data to download. The data-processing section 42 performs data processing, such as FAX besides speech processing, and a modem. As mentioned above, conversely, although the outline of operation at the time of wireless reception of this terminal was explained, when it sends out a sending signal from the wireless baseband section 41, D/A conversion of the sending-out signal is carried out in the AD section 3, and power amplification is carried out to frequency conversion by the RF transducer 2, and it is transmitted to a base station etc. through an antenna 1.

[0008] Next, the configuration of the software in the hardware of drawing 1 is explained. Drawing 2 is the software configuration Fig. of the radio terminal which used SR, and consists of the

baseband processing section 5, a download control section 6, and the communications control section 7. The baseband processing section 5 is software which processes software which performs each processing of the channel separation processing 51, the strange recovery processing 52, and the bit stream processing 53, and is downloaded including the basic function explained in the wireless baseband processing section 41 of above-mentioned drawing 1 . The download control section 6 controls download of software, and operates according to the control command sent before and after the data of download sent from a network side through the communications control section 7 mentioned later, and its data etc. Moreover, transmission and reception of the signal of the baseband processing section 5 are controlled. The communications control section 7 is the same as that of the conventional terminal, and is shown in following drawing 3 in detail.

[0009] Drawing 3 is drawing showing the software structure of the communications control section 7 of drawing 2 , and the layer structure of OSI is used for it by drawing 3 . In drawing 3 , the higher layer section (HMI) 17 performs the dial input from a keyboard, the various information displays to LCD, etc. Both the layer 3 (RT, MM, CC) section 15 and the higher layer section (RT, MM, CC) 16 which is the high order layer (a service layer is called) have a wireless function manager (RT), a migration function manager (MM), and a call processing function (CC). A wireless function manager (RT:Radio Frequency Transmission Management) means control of a wireless circuit, and a migration function manager (MM: Mobility Management) means location registration and authentication. A call processing function (CC: Call Control) means call connection control of dispatch, arrival, etc., and actuation based on ITU-T Q.931 is performed. The Rhea 2 section 14 indicated to be a layer 2 performs link access processing (LAPDM:Link Access Procedure for Digital Mobile channel), and carries out actuation based on ITU-T Q.921. The Rhea 1 section 13 performs the directions to channel coding of frame synchronization and a data frame, and the **-SUBANDO processing section 5. Under control of management 11, each layer is unified, and sends and receives a signal with a network. The software shown in these drawing 2 and drawing 3 operates on real-time OS. As mentioned above, as software of this operation gestalt, the baseband processing section 5 which is the object of download, and the download control section 6 and the communications control section 7 are constituted separately.

[0010] Next, the handling of the software to download is explained. As the approach of the download to a radio terminal from a network side, fundamentally, although it is carried out through wireless as mentioned above, in it, there are an approach of sending by the information channel (TCH) as "User Information" and the approach of sending by the control channel (CCH) as a "message" about the communications control transmitted by the layer 3 like voice or modem data about the program data to download. Generally, it is thought that it is appropriate to them to deal with it as "User Information" since program data, such as software, are not the "messages" about communications control. However, since data, such as voice, and FAX, a modem, are transmitted as "User Information" during the communication link, it is impossible for it to become impossible to use service usual in under download, and to perform software download to coincidence during the communication link of "User Information." Then, it enables it to deal with program data as a "message" with the operation gestalt of this invention. It becomes possible to use a control channel (CCH) for coincidence and to perform software download to it, transmitting voice etc. using an information channel (TCH), if it does in this way. The message used for download is taken as the "User Information" message of layer 3 call control. Since the transmission protocol of a message and coding being specified and the reason's being general and a call control message are transmitted by one frame of a layer 2, they are that a resending control function occurs. Moreover, it is because all one message of a standard of the "User Information" message and a layer 2 is diverted, so adjustment with the existing system can also be maintained.

[0011] In the standard, since the concrete operation of the "user user" information element specified as one of the elements of the "User Information" message was not specified, it incorporates a message there and was made to download by sending and receiving "User Information." Following seven are defined as a message (an "inclusion message" is called below) included in User Information.

(1) Software version demand : the information which shows the software class (for example, communications control, wireless baseband, download control) set as the object of a demand appears.
(2) Software version response : the software class set as the object of a response and its version information appear.
(3) Download control : the information which shows initiation/termination of the software class used as the candidate for download and download appears.
(4) Download response : the information which shows whether the software class used as the candidate for download, initiation/termination of download, and download control were received appears.
(5) Download data : the information which indicates a number of [the / which it divided] to be download data appears.
(6) Download data validation : the information which shows a number of [the / which the checked data divided] appears.
(7) The class and version information of the software downloaded [which downloaded and software-changed] appear.
[0012] Next, the sequence of download of software is explained. Drawing 4 is a message inspection sequence chart (it is called a sequence diagram Message Sequence Chart and the following) which shows the outline of the download in the operation gestalt of this invention. In this drawing, the version check:network of (1) software requires the version (S1) of terminal software, and a terminal returns a version (S2).
(2) Download initiation : a network returns delivery to this and a terminal returns a response (S4) for a download initiation command (S3).
(3) Download : divide the whole data and download it from a network to a terminal (S5). An error check etc. enters suitably during download.
(4) Download termination : after download of the whole data is completed, a network returns delivery to this and a terminal returns a response (S7) for a download termination command (S6).

(5) Software change : a network changes a software change command (S8) to the software which delivery and a terminal downloaded newly.
[0013] About the download (S5) shown in the sequence diagram of said drawing 4 , the detail is further shown in drawing 5 . In drawing 5 , the whole program to download is divided into two or more bytes so that it may appear in a "user user" information element. Calling Window the unit which performs resending control between a network and a terminal, one Window shall consist of N cutting tool. The whole data to download is first divided into M Window(s) (Win=1-/M-Win=M/M). Each of the download data divided into M pieces attaches a number (Div=1/N-Div=N/N) further for every Window of the, and is sent in order. This number is called Division. In drawing 5 , a terminal will return the response (S54) of the purport that reception of the Window (Win=1) concerned was checked, if the data (S51-S53) of N individual are received. A network transmits the data of the next Window (Win=2) in order (S55-S56) succeedingly, when transmission of one Window is successful in response to a response (S54).
[0014] Here, since the response (S57) of a check does not return to a network when reception of Window (Win=2) goes wrong for example, by the terminal side, the whole data of the Window (Win=2) is resent in a network. According to the above-mentioned procedure, download processing of Window is successively repeated until Window (Win=M) of the last of all data is sent out from a network (S58), the response (S59) is returned hereafter and download of all Window(s) finishes.
[0015] By the way, with the operation gestalt of this invention, as shown in drawing 3 , download is performed using the information element "a user user" of a layer 3 call-control message "User Information." Thereby, download is made possible through the control channel, performing voice transmission through an information channel. Furthermore, since the message of a standard is diverted, adjustment with the existing system can also be maintained.
[0016] Thus, with the operation gestalt of this invention, the system service as which the standardization was newly determined also in the mobile radio terminal can be immediately

offered [by giving the download function of software to the mobile radio terminal which used SR technique] after the standardization decision of the standardization decision of systems specification or before, or systems specification like modification by download of the system software in the base station of the conventional network. If it realizes according to this invention using SR technique which described above the dual mode terminal of a different access method like TDMA and CDMA, once by for example, the case where a mobile radio terminal is distributed by method of one of the two Even if it is the case where it changes into the method of another side of the software about the basic function of walkie-talkies, such as channel separation, strange recovery processing, and bit stream processing, it can be made to correspond to a communication mode which is different, without carrying out a hardware change by download which led the radio circuit. Furthermore, when it is made adapted for the dual mode machine of a digital cellular phone (PDC) and a CDMA method cellular phone, specifically, it is effective.

[0017] In addition, although the above-mentioned explanation explained the message used for download as "User Information" of call control, it can consider as the "operator proper information" on wireless management or migration management. In using an "operator proper information" message for download, there is no convention in the transmission protocol, coding, and a usage, and a degree of freedom comes out more from the operator having taken all. Moreover, since wireless management MESSE 1 JI and a migration management message are transmitted with the UI frame of a layer 2, compared with I frames, it passes and the advantage that there is little DDA and transmission speed becomes high comes out.

[0018] Next, the change to other channels or alien systems is explained. Drawing 6 is a flow chart which shows the change actuation to other channels. The part enclosed with a broken line is the judgment block of channel change conditions among drawing. In this drawing, a terminal is awaited and creates the table which carried out the firm measurement of the field strength of the discharge electric wave from two or more circumference base stations, compared them, and arranged the code of a base station in the strong sequence of an electric wave inside or during the communication link. L0 awaits the greatest thing and Lt1 for the receiving level of the base station under communication link, and Lm among the receiving level of a circumference base station, degradation level and Lt2 await, authorization level and **L=Lt1-Lt2 are zone shift level differences, the terminal has memorized these change information beforehand, or it is notified from a base station. A terminal changes a channel, when the predetermined criteria are met. In addition, by downloading software in the case of a channel change, the change to an alien system can be performed and a multimode mobile radio terminal can be realized. As mentioned above, although the example which performed the change to other channels or alien systems based on field strength was shown, if it considers as the parameter which shows a receive state, the rate of a word fault and a bit error rate may be used. Moreover, if it uses combining these two or more, since a receive state will be expressed more to a detail, it is effective by the opportunity of a change being shown. Moreover, different amendment of the covering area of a base station or a modulation technique for every system can be carried out by using the function of the field strength defined for every system as a receive state.

[0019] Although change actuation of the system in the terminal of drawing 6 is awaited and it is the system change inside or under communication link, the system decision of a power up is made as follows. Fig. 7 is a flow chart which shows set up tree channel scan actuation of a power up. To a power up, by scanning actuation according to said flow chart, a terminal measures the field strength of the electric wave of a circumference base station, compares them, and creates the table of a frequency at order with strong field strength. Although a **** awaits this actuation and it is the same as that of inner actuation, it is the description that the frequency which measures field strength is common to all systems.

[0020] Drawing 8 is a flow chart which shows system decision actuation of a power up. While setting up the frequency in the head of a table, parameters, such as a modulation technique common to all systems, an access method, and a bit rate, are set up (S1), and the layers 1, such as frame synchronization and CRC, are checked (S2). Although a **** awaits the above actuation and it is the same as that of inner actuation, it is the description that parameters to set up, such as a modulation technique and an access method, are common to all systems.

Information common to all systems is received after a setup of a parameter (S3). since the frequency of the system under service, channel structure, the modulation technique, the access method, the frame format, etc. are included in this common information in the area of a common base station -- a radical [information / that] -- awaiting -- a system -- determining -- (S4) -- it shifts to awaiting. When common information is unreceivable, the last channel is checked (S5) and a channel is set up again (S1). Here, conventionally, although it was confirming whether the combination of a parameter would remain, in this invention since [a parameter] it is common to all systems, it is not necessary to perform the check of combination and a system can be determined early. Thus, the next frequency of a table is received until it can perform reception of common information. The terminal applied to this invention as explained above is performing a set up tree channel scan common to all systems to a power up, setting up a modulation technique common to all systems, an access method, etc., and receiving common information, and it becomes clear what the system of a circumference base station is. For this reason, a system decision can be made promptly and a terminal can be used immediately.

[Translation done.]

* NOTICES *

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damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The configuration schematic diagram showing the hardware configuration of the mobile radio terminal concerning this invention.
[Drawing 2] The configuration schematic diagram showing the software configuration of the mobile radio terminal concerning this invention.
[Drawing 3] The configuration schematic diagram of the communications control section of drawing 2 .
[Drawing 4] The sequence diagram showing the outline of download of the software concerning this invention.
[Drawing 5] The sequence diagram showing the detail of download of the software concerning this invention.
[Drawing 6] The time of a communication link, and the flow chart Fig. in which awaiting and showing the channel change approach at the time.
[Drawing 7] The flow chart Fig. showing set up tree channel scan actuation of a power up.
[Drawing 8] The flow chart Fig. showing system decision actuation of the power up concerning this invention.
[Description of Notations]
1 [.. Software processing section,] .. An antenna, 2 .. RF transducer, 3 .. A broadband A/D-D/A transducer, 4 5 .. The baseband processing section, 6 .. Download control section, 7 .. The communications control section, 11 .. Management section, 12 .. The real-time OS section, 13 .. The layer 1 section 14 .. The layer 2 section, 15 .. The layer 3 section, 16 .. Higher layer section (RT, MM, CC), 17 .. Higher layer section (HMI) 41 [43 .. Control section 51 / 53 .. Bit stream processing / .. Channel separation processing, 52 .. Modulation recovery processing] .. The wireless baseband processing section, 42 .. Data-processing section

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[Translation done.]

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BB21 DD01 DD34 DD43 DD46
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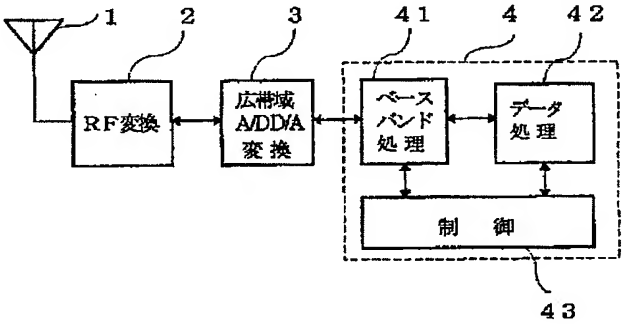
HH22 HH23 JJ13 JJ22

(54)【発明の名称】　移動無線端末

(57)【要約】
【課題】一つの端末で、すばやく複数の異なった移動通信システム間でネットワークを切り替えながら通信できる移動無線端末を提供する。
【解決手段】ソフトウェア技術を用い、ソフトウェアをベースバンド処理部５、ダウンロード制御部６、通信制御部６で構成し、レイヤ３呼制御「ユーザ情報」メッセージを介してソフトウェアダウンロードを行うようにする。



【特許請求の範囲】

【請求項１】　所定の全帯域の周波数で無線送受信が可能な広帯域無線送受信手段と、前記広帯域無線送受信手段で送受信される広帯域の無線アナログ信号と無線ディジタル信号を双方向で変換可能な広帯域Ａ／Ｄ－Ｄ／Ａ変換手段と、ソフトウエア・ラジオ技術を用いて前記無線ディジタル信号にチャネル分離と変復調処理を含むディジタル無線通信に必要な無線ベースバンド処理を実施すると共に該無線ベースバンド処理前後の音声帯域データ処理及び前記各手段を含む移動無線端末の各部の制御処理を実施可能なデジタル信号処理手段を有する移動無線端末であって、前記デジタル信号処理手段は、前記無線通信に使用される受信回線から無線機能を定義するソフトウエアを含む前記ソフトウエア・ラジオ技術を用いたソフトウェアをダウンロードして記憶し、該記憶したソフトウェアを起動して少なくとも前記無線ベースバンド処理の実施が可能であり、複数の異なる移動通信システムの内の一つを選択し、複数の異なる移動通信システム間での通信を可能としたことを特徴とする移動無線端末。

【請求項２】　前記移動無線端末は、電源投入時に全システムに共通のとまり木チャネルスキャンを行い、全システムに共通の変調方式、アクセス方式等のパラメータを設定し、全システムに共通の情報を受信することによって、周辺基地局のシステムが何であるのかを判定することを特徴とする請求項１記載の移動無線端末。

【請求項３】　前記ソフトウェアのダウンロードは、制御チャネルを使用したメッセージとして実施されることを特徴とする請求項１または２記載の移動無線端末。

【請求項４】　前記ソフトウェアのダウンロードは、開放型システム間相互接続（ＯＳＩ）モデルにおけるレイヤ３呼制御の「ユーザ情報」メッセージの「ユーザ・ユーザ」情報要素を介して行うことを特徴とする請求項１乃至３記載の移動無線端末。

【請求項５】　前記ソフトウェアのダウンロードは、開放型システム間相互接続（ＯＳＩ）モデルにおけるレイヤ３無線管理メッセージ又は移動管理メッセージ「オペレータ固有情報」を介して行うことを特徴とする請求項１乃至３記載の移動無線端末。

【請求項６】　前記ダウンロードされる無線機能を定義するソフトウエアには、少なくとも、要求の対象となるソフトウエアの種類を示す情報を含むソフトウエア要求と、応答の対象となるソフトウエアの種類とバージョンを示す情報を含むソフトウエア応答と、ダウンロードの対象となるソフトウエアの種類とダウンロードの開始と終了を示す情報を含むダウンロード制御と、ダウンロードの対象となるソフトウエアの種類とダウンロードの開始と終了及びダウンロードの受付の可否を示す情報を含むダウンロード応答と、そのダウンロードデータが分割した何番目かを示す情報を含むダウンロードデータと、確認したダウンロードデータが分割した何番目かを示す情報を含むダウンロードデータ確認と、ダウンロードしたソフトウエアの種類とバージョンを示す情報を含むソフトウエア切替との各組み込みメッセージの定義を含むことを特徴とする請求項１～５の何れか１項に記載の移動無線端末。

【請求項７】　前記移動無線端末は複数の基地局からの信号の受信状態を測定し、受信状態が変化した際に他のチャネル又は他のシステムに切り替えるものであって、前記受信状態は電界強度、ワード誤り率、ビット誤り率のうちのいずれか一つ、またはこれらの二以上の組み合わせであることを特徴とする請求項１～６の何れか１項に記載の移動無線端末。

【請求項８】　前記受信状態は移動通信システム毎に定めた電界強度の関数であることを特徴とする請求項７に記載の移動無線端末。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、複数の異なる移動通信システム間でネットワークを切り替えながら通信する移動無線端末に関し、更に詳しくは、無線通信に使用するソフトウェアをダウンロードにより得るソフトウエア・ラジオ技術を用いた移動無線端末に関する。

【０００２】

【従来の技術】近年、携帯電話やＰＨＳやページャー等が急速に普及すると共に、それらの移動通信ネットワークにおいては、新サービスの追加やデータ通信対応による通信機能の高度化、或いは、ネットワーク上の機能や仕様の多様化が進んでいる。即ち、いつでも、どこでも、誰とでも、どんなデータでも通信できる、マルチメディア移動体通信によって、音声はもちろん、画像、動画、データ、文字、音楽等を含む通信が可能となっている。しかし、世界中には多種の移動通信システムが存在し、これらの間に互換性はない。このため、実際に世界中を移動して、どの移動先においても携帯型の通信を行うためには、各移動通信システムの端末を用意するか、マルチモード端末を使用しなければならなかった。この問題を解決するため、世界統一システムであるＩＭＴ２０００の標準化がＩＴＵ－Ｔで行われているが、その標準化が実現するまでの間は既存システムを使用せざるを得ない。従来、マルチモード端末としては、例えば特開平１０－８４５８３号、特開平１０－８４５８４号公報等に、一つの端末の中に複数のシステムに対応する回路を用意してそれら回路を切り替える装置が提案されており、これらの手段によれば、異なる周波数やプロトコルを用いるシステムのサービス地域へ移動した際も、中断することなく通信を継続することができるものである。

【０００３】

【発明の解決しようとする課題】しかしながら、従来のマルチモード移動無線端末では、一つの端末中に複数の

システムに対応する回路を用意しなければならず、各システムの専用端末に比べて小型軽量化、消費電力の低減という要請を十分に達成できないという問題があった。小型化を実現しようとすれば物理的に収容できる回路数には限界が生じるため、回路が用意されているシステムへの切替はできるものの、回路が用意されていないシステムへの切替はできないという問題があった。本発明の目的は、上記した問題を解決するためになされたものであって、従来はハードウェアで構成していた変復調処理等の無線機の基本機能を、ソフトウエア・ラジオ（ＳＲ）技術を用いてソフトウェアで記述し、その基本機能をもダウンロードすることにより、すばやく複数の異なった移動通信システム間でネットワークを切り替えながら通信するマルチモード移動無線端末を提供することである。

【０００４】

【課題を解決するための手段】上記課題を解決するため、請求項１の発明においては、所定の全帯域の周波数で無線送受信が可能な広帯域無線送受信手段と、前記広帯域無線送受信手段で送受信される広帯域の無線アナログ信号と無線ディジタル信号を双方向で変換可能な広帯域Ａ／Ｄ－Ｄ／Ａ変換手段と、ソフトウエア・ラジオ技術を用いて前記無線ディジタル信号にチャネル分離と変復調処理を含むディジタル無線通信に必要な無線ベースバンド処理を実施すると共に該無線ベースバンド処理前後の音声帯域データ処理及び前記各手段を含む移動無線端末の各部の制御処理を実施可能なデジタル信号処理手段を有する移動無線端末であって、前記デジタル信号処理手段は、前記無線通信に使用される受信回線から無線機能を定義するソフトウエアを含む前記ソフトウエア・ラジオ技術を用いたソフトウェアをダウンロードして記憶し、該記憶したソフトウェアを起動して少なくとも前記無線ベースバンド処理の実施が可能であり、複数の異なる移動通信システムの内の一つを選択し、複数の異なる移動通信システム間での通信を可能としたことを特徴とする。請求項２の発明においては、請求項１に記載の移動無線端末において、前記移動無線端末は、電源投入時に全システムに共通のとまり木チャネルスキャンを行い、全システムに共通の変調方式、アクセス方式等のパラメータを設定し、全システムに共通の情報を受信することによって、周辺基地局のシステムが何であるのかを判定することを特徴とする。請求項３の発明においては、請求項１または２に記載の移動無線端末において、前記ソフトウェアのダウンロードは、制御チャネルを使用したメッセージとして実施されることを特徴とする。請求項４の発明においては、請求項１乃至３に記載の移動無線端末において、前記ソフトウェアのダウンロードは、開放型システム間相互接続（ＯＳＩ）モデルにおけるレイヤ３呼制御の「ユーザ情報」メッセージの「ユーザ・ユーザ」情報要素を介して行うことを特徴とする。請求項５の発明においては、請求項１乃至３に記載の移動無線端末において、前記ソフトウェアのダウンロードは、開放型システム間相互接続（ＯＳＩ）モデルにおけるレイヤ３無線管理メッセージ又は移動管理メッセージ「オペレータ固有情報」を介して行うことを特徴とする。請求項６の発明においては、請求項１～５の何れか１項に記載の移動無線端末において、前記ダウンロードされる無線機能を定義するソフトウエアには、少なくとも、要求の対象となるソフトウエアの種類を示す情報を含むソフトウエア要求と、応答の対象となるソフトウエアの種類とバージョンを示す情報を含むソフトウエア応答と、ダウンロードの対象となるソフトウエアの種類とダウンロードの開始と終了を示す情報を含むダウンロード制御と、ダウンロードの対象となるソフトウエアの種類とダウンロードの開始と終了及びダウンロードの受付の可否を示す情報を含むダウンロード応答と、そのダウンロードデータが分割した何番目かを示す情報を含むダウンロードデータと、確認したダウンロードデータが分割した何番目かを示す情報を含むダウンロードデータ確認と、ダウンロードしたソフトウエアの種類とバージョンを示す情報を含むソフトウエア切替との各組み込みメッセージの定義を含むことを特徴とする。請求項７の発明においては、請求項１～６の何れか１項に記載の移動無線端末において、前記移動無線端末は複数の基地局からの信号の受信状態を測定し、受信状態が変化した際に他のチャネル又は他のシステムに切り替えるものであって、前記受信状態は電界強度、ワード誤り率、ビット誤り率のうちのいずれか一つ、またはこれらの二以上の組み合わせであることを特徴とする。請求項７の発明においては、請求項７に記載の移動無線端末において、前記受信状態は移動通信システム毎に定めた電界強度の関数であることを特徴とする。

【０００５】

【発明の実施の形態】最初に、本発明で利用するソフトウエア・ラジオ技術（以下、ＳＲと記載する。）について説明する。ＳＲは、変復調方式、アクセス方式等の無線機の基本機能を、ソフトウェアで実現するものであり、ハードウェアの変更を行うことなく、ソフトウェアを書き替えるだけで無線端末の基本機能を容易に変更できるものである。ＳＲ端末における「システム拡張」機能は、例えば無線を通じてダウンロードにより行われ、上記したようなハードウエアに依存する技術の限界も、上記「システム拡張」により、ＶＨＤＬ（Verilog Hardware Discript Language）等をダウンロードすることにより克服される。なお、ＳＲの詳細については、Joe Mitola：“The Software Radio Architecture”, IEEE Communications Magazine, Vol.33, No. 5, ｐｐ. 26-38（May 1995）に述べられている。

【０００６】以下に、本発明の実施形態を、ハードウェア構成、ソフトウェア構成、ダウンロードするソフトウ

ェアの取扱い、ダウンロードシーケンスの順に、図面に示した実施の形態に基づいて説明する。図１は、本発明に係わるＳＲを用いた端末の一般的なハードウエアの構成を示す構成概要図である。同図に示すように、本端末は、アンテナ１、ＲＦ変換部２、広帯域Ａ／Ｄ－Ｄ／Ａ変換部（以下、ＡＤ部という）３及びソフトウエア処理部４から構成され、ソフトウエア処理部４は、更に、無線ベースバンド処理部４１、データ処理部４２及び制御部４３から構成される。上記の構成のうち、ソフトウェア処理部４が、本発明の特徴であるソフトウエアのダウンロードが適用される部分であり、その中でも特に無線ベースバンド処理部４１は、従来の技術ではハードウエアで構成され、ソフトウエアによる処理が行われておらず、従って、ダウンロードの対象にはなっていなかった部分である。

【０００７】上記の構成の端末の動作は次の通りである。アンテナ１から入力した広帯域信号は、ＲＦ変換部２で中間周波数ＩＦに変換される。このＩＦ信号は、広帯域のままＡＤ部３へ送られる。ＡＤ部３では、入力した広帯域信号を一括してデジタル信号に変換し、ソフトウエア処理部４の中の無線ベースバンド処理部４１へ出力する。無線ベースバンド処理部４１では、前記ＳＲ技術により、チャネル分離、変復調、誤り訂正等のビット操作の「チャネル処理」を行う。無線ベースバンド処理部４１の処理は、従来の構成ではハードウェアで行っていたものであるが、本端末では、ＤＳＰ（Digital Signal Processor）等の高速プログラマブル・プロセッサ上のソフトウェアで行われる。無線ベースバンド処理部４１からのデジタル信号のうち音声等は、データ処理部４２へ送られ、通信制御データは、制御部４３へ送られる。制御部４３は、無線ベースバンド処理部４１から送られてきた通信制御データに基づき、無線回線制御、呼接続制御等を行うもので、ダウンロードするデータ用に系を２つ有している。データ処理部４２は、音声処理の他、ＦＡＸ、モデム等のデータ処理を行う。以上、本端末の無線受信時の動作概略を説明したが、逆に、無線ベースバンド部４１から送信信号を送出する場合は、その送出信号は、ＡＤ部３でＤ／Ａ変換され、ＲＦ変換部２で周波数変換と電力増幅され、アンテナ１を介して基地局等へ送信される。

【０００８】次に、図１のハードウエアにおけるソフトウェアの構成を説明する。図２は、ＳＲを用いた無線通信端末のソフトウェア構成図であり、ベースバンド処理部５、ダウンロード制御部６及び通信制御部７から構成される。ベースバンド処理部５は、上記した図１の無線ベースバンド処理部４１で説明した基本機能を含み、チャネル分離処理５１、変復調処理５２、ビットストリーム処理５３の各処理を行うもので、ダウンロードされるソフトウエアの処理を実施するソフトウエアである。ダウンロード制御部６は、ソフトウェアのダウンロードの制御を行うもので、後述する通信制御部７を介してネットワーク側から送られてくるダウンロードのデータや、そのデータの前後等に送られてくる制御コマンドに従って動作する。また、ベースバンド処理部５の信号の送受を制御する。通信制御部７は、従来の端末と同様であり、詳しくは、次の図３に示す。

【０００９】図３は、図２の通信制御部７のソフトウエア構造を示す図であり、図３では、ＯＳＩのレイヤ構造を採用する。図３中で、高次レイヤ部（ＨＭＩ）１７は、キーボードからのダイヤル入力や、ＬＣＤへの各種情報表示等を行う。レイヤ３（ＲＴ、ＭＭ、ＣＣ）部１５とその上位レイヤ（サービスレイヤと称する）である高次レイヤ部（ＲＴ、ＭＭ、ＣＣ）１６とは、共に無線管理機能（ＲＴ）、移動管理機能（ＭＭ）、呼処理機能（ＣＣ）を有する。 無線管理機能（ＲＴ：Radio Frequency Transmission Management）とは、無線回線の制御を意味し、移動管理機能（ＭＭ： Mobility Management）とは、位置登録及び認証を意味する。呼処理機能（ＣＣ： Call Control）とは、発信、着信等の呼接続制御を意味し、ＩＴＵ－Ｔ Ｑ．９３１に準拠した動作を行う。 レイヤ２と示されたレイア2部１４は、リンクアクセス処理（ＬＡＰＤＭ：Link Access Procedure for Digital Mobile channel）を行い、ＩＴＵ－Ｔ Ｑ．９２１に準拠した動作をする。レイア1部１３は、フレーム同期、データフレームのチャネルコーディング及びベースバンド処理部５への指示を行う。各レイヤは、マネジメント１１の制御の下、統合してネットワークとの信号の送受を行う。これら図２と図３に示したソフトウェアは、リアルタイムＯＳ上で動作する。以上のように、本実施形態のソフトウェアとしては、ダウンロードの対象であるベースバンド処理部５と、ダウンロード制御部６及び通信制御部７とを別々に構成する。

【００１０】次に、ダウンロードするソフトウェアの取り扱いについて説明する。ネットワーク側から無線通信端末へのダウンロードの方法としては、基本的には、前述した通り無線を通じて行われるが、その中では、ダウンロードするプログラムデータを、音声やモデムデータと同じように「ユーザ情報」として、情報チャネル（ＴＣＨ）で送る方法と、レイヤ３で転送される通信制御に関する「メッセージ」として、制御チャネル（ＣＣＨ）で送る方法とがある。一般的には、ソフトウエア等のプログラムデータは、通信制御に関する「メッセージ」ではないので、「ユーザ情報」として取り扱うのが妥当と考えられる。しかし、通信中には「ユーザ情報」として、音声やＦＡＸ、モデム等のデータが伝送されているため、ダウンロード中は通常のサービスが利用できなくなってしまい、「ユーザ情報」の通信中に、同時にソフトウェアダウンロードを行うのは不可能である。そこで、本発明の実施形態では、プログラムデータを「メッセージ」として取り扱えるようにしている。このように

すれば、情報チャネル（ＴＣＨ）を用いて音声等の伝送を行いつつ、同時に、制御チャネル（ＣＣＨ）を用いてソフトウェアダウンロードを行うことが可能となる。ダウンロードに用いるメッセージは、レイヤ３呼制御の「ユーザ情報」メッセージとする。その理由は、メッセージの伝送手順及びコーディングが規定されていて一般性があること、呼制御メッセージは、レイヤ２の１フレームで伝送されるため、再送制御機能があることである。また、「ユーザ情報」メッセージ、レイヤ２の１フレーム共、標準規格のメッセージを流用するので、既存システムとの整合性も保てるからである。

【００１１】「ユーザ情報」メッセージの要素の一つとして規定されている「ユーザ・ユーザ」情報要素の具体的使用方法は、標準規格では規定されていないため、そこにメッセージを組み込み、「ユーザ情報」を送受することによってダウンロードを行うようにした。ユーザ情報に組み込むメッセージ（以下「組み込みメッセージ」と称す）として、以下の７つを定義する。

（１）ソフトウエアバージョン要求：要求の対象となるソフト種類（例えば、通信制御、無線ベースバンド、ダウンロード制御）を示す情報が載る。

（２）ソフトウェアバージョン応答：応答の対象となるソフト種類とそのバージョン情報が載る。

（３）ダウンロード制御：ダウンロード対象となるソフト種類とダウンロードの開始／終了を示す情報が載る。

（４）ダウンロード応答：ダウンロード対象となるソフト種類、ダウンロードの開始／終了、及びダウンロード制御を受け付けたか否かを示す情報が載る。

（５）ダウンロードデータ：ダウンロードデータと、それが分割した何番目かを示す情報が載る。

（６）ダウンロードデータ確認：確認したデータが分割した何番目かを示す情報が載る。

（７）ソフトウェア切替：ダウンロードしたソフトの種類とそのバージョン情報が載る。

【００１２】次に、ソフトウェアのダウンロードのシーケンスについて説明する。図４は、本発明の実施形態におけるダウンロードの概略を示すメッセージ・シーケンス・チャート（ Message Sequence Chart、以下、シーケンス図という）である。同図において、

（１）ソフトウェアのバージョンチェック：ネットワークは、端末ソフトウェアのバージョン（Ｓ１）を要求し、端末は、バージョン（Ｓ２）を返す。

（２）ダウンロード開始：ネットワークは、ダウンロード開始指令（Ｓ３）を送り、端末はこれに応答（Ｓ４）を返す。

（３）ダウンロード：データ全体は分割してネットワークから端末へダウンロード（Ｓ５）される。ダウンロード中、誤りチェック等が適宜入る。

（４）ダウンロード終了：データ全体のダウンロードが終了すると、ネットワークは、ダウンロード終了指令（Ｓ６）を送り、端末はこれに応答（Ｓ７）を返す。

（５）ソフトウェア切替：ネットワークは、ソフトウェア切替指令（Ｓ８）を送り、端末は新しくダウンロードしたソフトウェアに切り替える。

【００１３】前記図４のシーケンス図に示されたダウンロード（Ｓ５）について、更にその詳細を、図５に示す。図５において、ダウンロードされるプログラム全体は、「ユーザ・ユーザ」情報要素に載るように複数バイトに分割される。ネットワークと端末との間で再送制御を行う単位をＷｉｎｄｏｗと称し、１つのＷｉｎｄｏｗは、Ｎバイトから成るものとする。ダウンロードされるデータ全体は、まずＭ個のＷｉｎｄｏｗに分割（Ｗｉｎ＝１／Ｍ～Ｗｉｎ＝Ｍ／Ｍ）される。Ｍ個に分割されたダウンロードデータの各々は、そのＷｉｎｄｏｗ毎に更に番号（Ｄｉｖ＝１／Ｎ～Ｄｉｖ＝Ｎ／Ｎ）を付して順番に送られる。この番号をＤｉｖｉｓｉｏｎと称する。図５では、端末は、Ｎ個のデータ（Ｓ５１～Ｓ５３）を受信すると、当該Ｗｉｎｄｏｗ（Ｗｉｎ＝１）の受信を確認した旨の応答（Ｓ５４）を返す。ネットワークは、応答（Ｓ５４）を受けて１つのＷｉｎｄｏｗの送信が成功した場合には、引き続き、次のＷｉｎｄｏｗ（Ｗｉｎ＝２）のデータを順番（Ｓ５５～Ｓ５６）に送信する。

【００１４】ここで、例えば、端末側でＷｉｎｄｏｗ（Ｗｉｎ＝２）の受信に失敗した場合は、確認の応答（Ｓ５７）がネットワークに返らないので、ネットワークでは、そのＷｉｎｄｏｗ（Ｗｉｎ＝２）のデータ全体を再送する。以下、全データの最後のＷｉｎｄｏｗ（Ｗｉｎ＝Ｍ）がネットワークから送出（Ｓ５８）されて、その応答（Ｓ５９）が返されて、全てのＷｉｎｄｏｗのダウンロードが終わるまで、上記手順に従って、順次Ｗｉｎｄｏｗのダウンロード処理を繰り返される。

【００１５】ところで、本発明の実施形態では、図３に示したように、ダウンロードをレイヤ３呼制御メッセージ「ユーザ情報」の情報要素「ユーザ・ユーザ」を用いて行っている。これにより、情報チャネルを介して音声伝送を行いつつ、制御チャネルを介してダウンロードを可能としている。更に、標準規格のメッセージを流用しているので、既存システムとの整合性も保てる。

【００１６】このように、本発明の実施形態では、ＳＲ技術を用いた移動無線端末にソフトウェアのダウンロード機能を持たせることにより、従来のネットワークの基地局におけるシステムソフトウエアのダウンロードによる変更と同様に、システム仕様の標準化決定以前に、または、システム仕様の標準化決定後、直ちに、移動無線端末においても新たに標準化が決定されたシステムサービスを提供することができる。例えば、ＴＤＭＡとＣＤＭＡのように異なるアクセス方式のデュアルモード端末を、上記したＳＲ技術を用いて本発明に従って実現すれば、一旦、片方の方式で移動無線端末を配布した場合で、チャネル分離、変復調処理、ビットストリーム処理

など無線機の基本機能に関するソフトウェアの他方の方式に変更する場合であっても、無線通信回線を通じたダウンロードにより、ハードウェアの変更をせずに異なる通信方式に対応させることができる。更に具体的には、デジタル携帯電話（ＰＤＣ）とＣＤＭＡ方式携帯電話とのデュアルモード機に適応させた場合には有効である。

【００１７】尚、上記説明では、ダウンロードに用いるメッセージを、呼制御の「ユーザ情報」として説明したが、無線管理、又は、移動管理の「オペレータ固有情報」とすることができる。「オペレータ固有情報」メッセージをダウンロードに用いる場合には、その伝送手順、コーディング、使用法とも規定がなく、全てオペレータに要されていることから、より自由度が出てくる。また、無線管理メッセージ、及び、移動管理メッセージは、レイヤ２のＵＩフレームで伝送されるため、ＩフレームＩに比べて、ヘッダが少なく、伝送速度が高くなるという利点が出てくる。

【００１８】次に、他のチャネル又は他のシステムへの切り替えについて説明する。図６は他のチャネルへの切り替え動作を示すフローチャートである。図中、破線で囲んだ部分はチャネル切り替え条件の判定ブロックである。同図において、端末は待ち受け中または通信中に、複数の周辺基地局からの発射電波の電界強度を常時測定し、それらを比較して電波の強い順序で基地局のコードを配列したテーブルを作成する。Ｌ０は通信中の基地局の受信レベル、Ｌｍは周辺基地局の受信レベルのうち最大のもの、Ｌｔ１は待ち受け劣化レベル、Ｌｔ２は待ち受け許可レベル、ΔＬ＝Ｌｔ１－Ｌｔ２はゾーン移行レベル差であり、これら切替情報は端末が予め記憶しているか、または基地局から通知される。端末は所定基準を満たした時にチャネルの切り替えを行う。なお、チャネル切り替えの際にソフトウェアをダウンロードすることによって、他のシステムへの切り替えができ、マルチモード移動無線端末を実現することができる。以上、他のチャネル又は他のシステムへの切り替えを電界強度に基づいて行った例を示したが、受信状態を示すパラメータとしては、この他にワード誤り率、ビット誤り率を用いてもよい。また、これらを２以上組み合わせて用いれば、受信状態をより詳細に表すことになるので、切り替えの契機を示すのにより有効である。また、受信状態としてシステム毎に定めた電界強度の関数を用いることによって、システム毎に異なる基地局のカバーエリアや変調方式の補正をすることができる。

【００１９】図６の端末におけるシステムの切り替え動作は、待ち受け中あるいは通信中のシステム切り替えであるが、電源投入時のシステム決定は次のように行う。第７図は電源投入時のとまり木チャネルスキャン動作を示すフローチャートである。端末は電源投入時に、前記フローチャートに従ったスキャン動作によって、周辺基地局の電波の電界強度を測定し、それらを比較して電界強度の強い順に周波数のテーブルを作成する。この動作は上述の待ち受け中における動作と同様であるが、電界強度を測定する周波数が全システムに共通のものであることが特徴である。

【００２０】図８は電源投入時のシステム決定動作を示すフローチャートである。テーブルの先頭にある周波数を設定すると共に、全システムに共通の変調方式、アクセス方式、ビットレート等のパラメータを設定し（Ｓ１）、フレーム同期、ＣＲＣ等レイヤ１をチェックする（Ｓ２）。以上の動作は上述の待ち受け中における動作と同様であるが、設定する変調方式、アクセス方式等のパラメータが全システムに共通のものであることが特徴である。パラメータの設定後、全システムに共通の情報を受信する（Ｓ３）。この共通情報には、共通基地局のエリア内でサービス中のシステムの周波数、チャネル構造、変調方式、アクセス方式、フレームフォーマット等が含まれているので、その情報を基に待ち受けシステムを決定し（Ｓ４）、待ち受けに移行する。共通情報が受信できない場合、最後のチャネルのチェック（Ｓ５）を行い、チャネルの設定（Ｓ１）を再度行う。ここで、従来はパラメータの組み合わせが残っているかをチェックしていたが、本発明においては、パラメータは全システムに共通とするので、組み合わせのチェックは行わなくてよく、システムの決定が早く行える。このようにして共通情報の受信ができるまでテーブルの次の周波数を受信する。以上説明したように本発明に係る端末は、電源投入時に全システムに共通のとまり木チャネルスキャンを行い、全システムに共通の変調方式、アクセス方式等を設定し、共通情報を受信することで、周辺基地局のシステムが何であるのかが判明する。このため、システム決定を速やかに行うことができ、端末を直ちに使うことができる。

【００２１】

【発明の効果】以上説明したように、本発明に係る移動無線端末では、ＳＲ技術を用い、ソフトウェアを無線ベースバンド処理部、ダウンロード制御部、通信制御部で構成し、レイヤ３呼制御「ユーザ情報」メッセージを介してソフトウェアダウンロードを行うようにしたので、移動無線端末における変復調方式等の基本機能自体の変更を容易に実施することができ、マルチモード移動無線端末を実現することができる。更に、電源投入時に全システムに共通のとまり木チャネルスキャンを行い、全システムに共通の変調方式、アクセス方式等を設定し、共通情報を受信することによって周辺基地局のシステムが何であるのかが判断するようにしたので、電源投入時のシステム決定を高速に実現することができる。

【図面の簡単な説明】

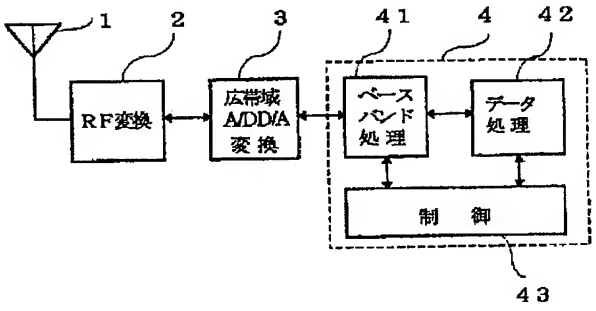
【図１】本発明に係る移動無線端末のハードウェア構成を示す構成概要図。

【図２】本発明に係る移動無線端末のソフトウェア構成

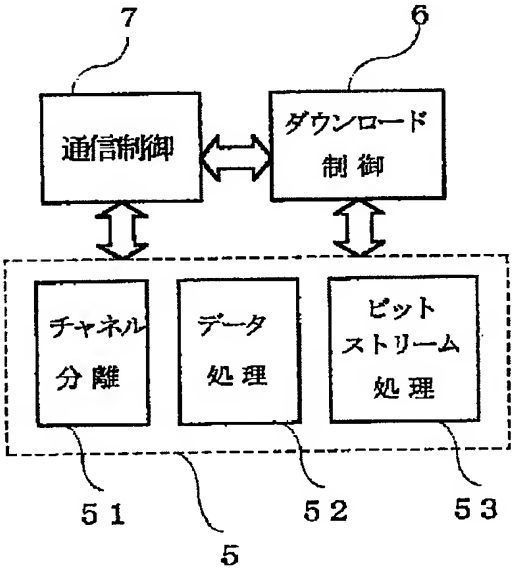
を示す構成概要図。
【図３】図２の通信制御部の構成概要図。
【図４】本発明に係るソフトウェアのダウンロードの概略を示すシーケンス図。
【図５】本発明に係るソフトウェアのダウンロードの詳細を示すシーケンス図。
【図６】通信時及び待ち受け時のチャネル切り替え方法を示すフローチャート図。
【図７】電源投入時のとまり木チャネルスキャン動作を示すフローチャート図。
【図８】本発明に係る電源投入時のシステム決定動作を示すフローチャート図。

【符号の説明】
１・・アンテナ、２・・ＲＦ変換部、３・・広帯域Ａ／Ｄ－Ｄ／Ａ変換部、４・・ソフトウエア処理部、５・・ベースバンド処理部、６・・ダウンロード制御部、７・・通信制御部、１１・・マネジメント部、１２・・リアルタイムＯＳ部、１３・・レイヤ１部、１４・・レイヤ２部、１５・・レイヤ３部、１６・・高次レイヤ部（ＲＴ、ＭＭ、ＣＣ）、１７・・高次レイヤ部（ＨＭＩ）、４１・・無線ベースバンド処理部、４２・・データ処理部、４３・・制御部、５１・・チャネル分離処理、５２・・変調復調処理、５３・・ビットストリーム処理

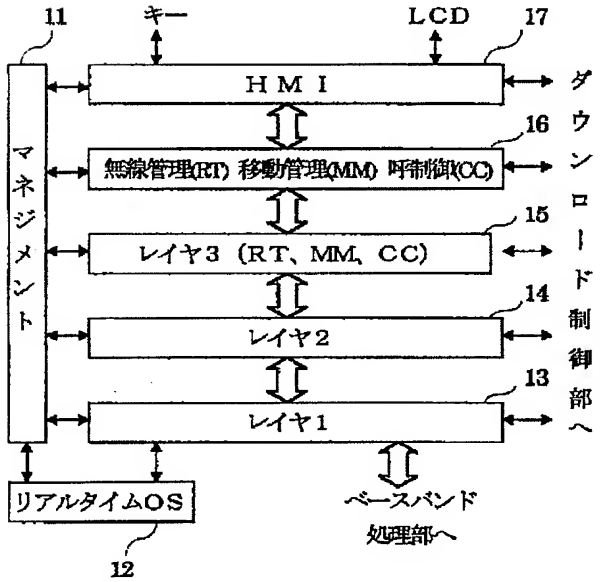
【図１】



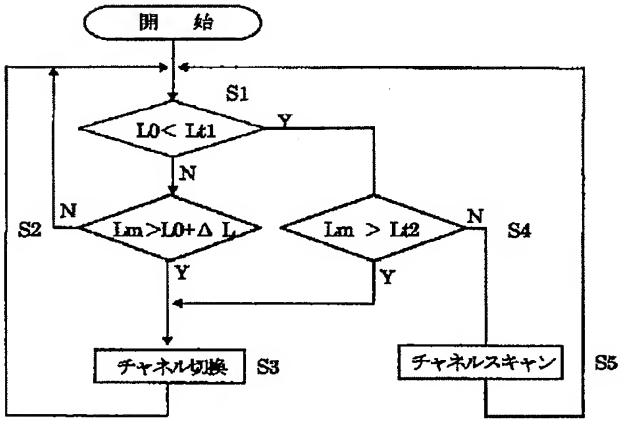
【図２】



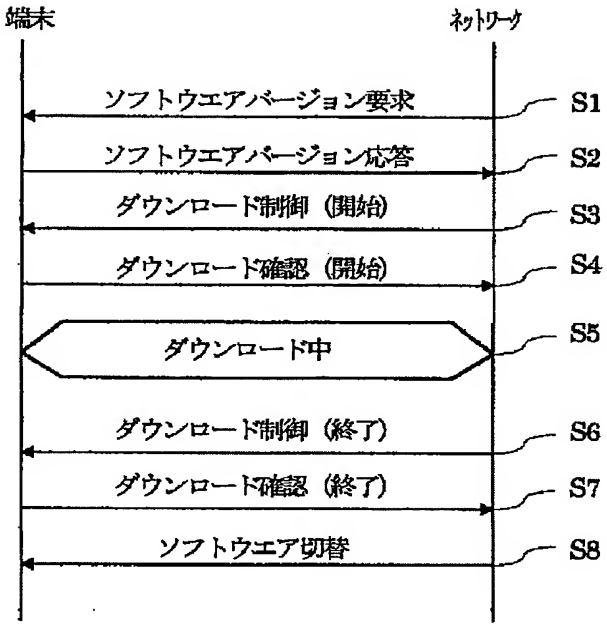
【図３】



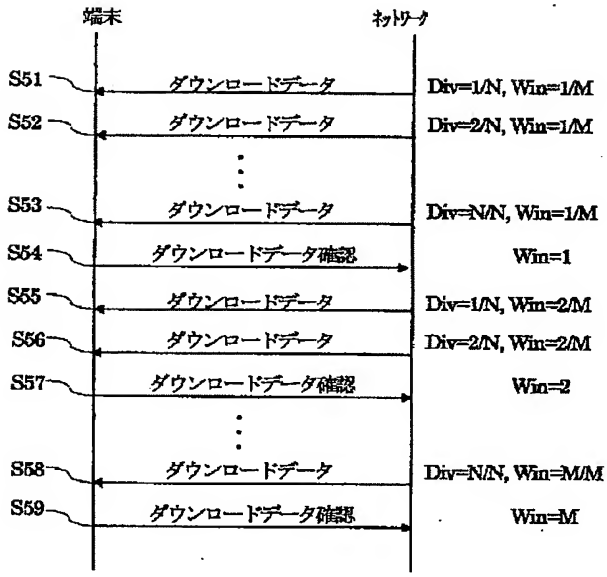
【図６】



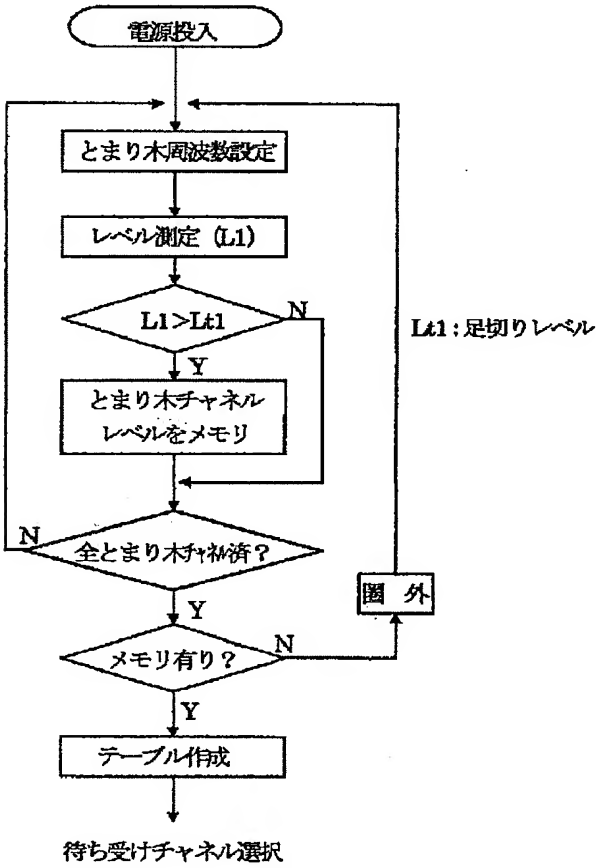
【図４】


端末
ネットワーク
ソフトウエアバージョン要求
S1
ソフトウエアバージョン応答
S2
ダウンロード制御（開始）
S3
ダウンロード確認（開始）
S4
ダウンロード中
S5
ダウンロード制御（終了）
S6
ダウンロード確認（終了）
S7
ソフトウエア切替
S8

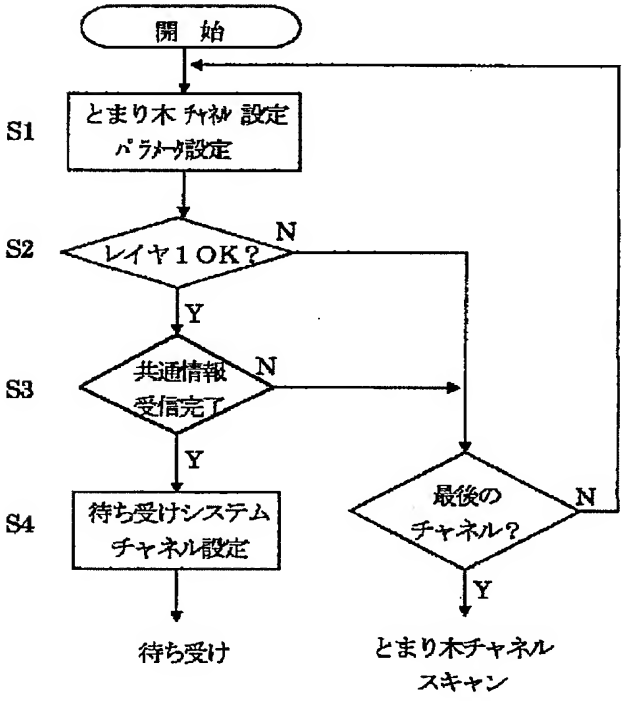
【図５】


端末
ネットワーク
S51 ダウンロードデータ Div=1/N, Win=1/M
S52 ダウンロードデータ Div=2/N, Win=1/M
S53 ダウンロードデータ Div=N/N, Win=1/M
S54 ダウンロードデータ確認 Win=1
S55 ダウンロードデータ Div=1/N, Win=2/M
S56 ダウンロードデータ Div=2/N, Win=2/M
S57 ダウンロードデータ確認 Win=2
S58 ダウンロードデータ Div=N/N, Win=M/M
S59 ダウンロードデータ確認 Win=M

【図７】


電源投入
とまり木周波数設定
レベル測定（L1）
L1>Lt1
N
Y
とまり木チャネル
レベルをメモリ
全とまり木ﾁｬﾈﾙ済？
N
Y
メモリ有り？
N
Y
テーブル作成
待ち受けチャネル選択
圏 外
Lt1：足切りレベル

【図８】


開 始
S1
とまり木 ﾁｬﾈﾙ 設定
ﾊﾟﾗﾒｰﾀ設定
S2
レイヤ１OK？
N
Y
S3
共通情報
受信完了
N
Y
S4
待ち受けシステム
チャネル設定
待ち受け
最後の
チャネル？
N
Y
とまり木チャネル
スキャン